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**Northern
Region**

Montana
Department of
State Lands

Division of
Forestry

Report 82-2

March 1982

Forest Insect and Disease Conditions 1981 in Montana

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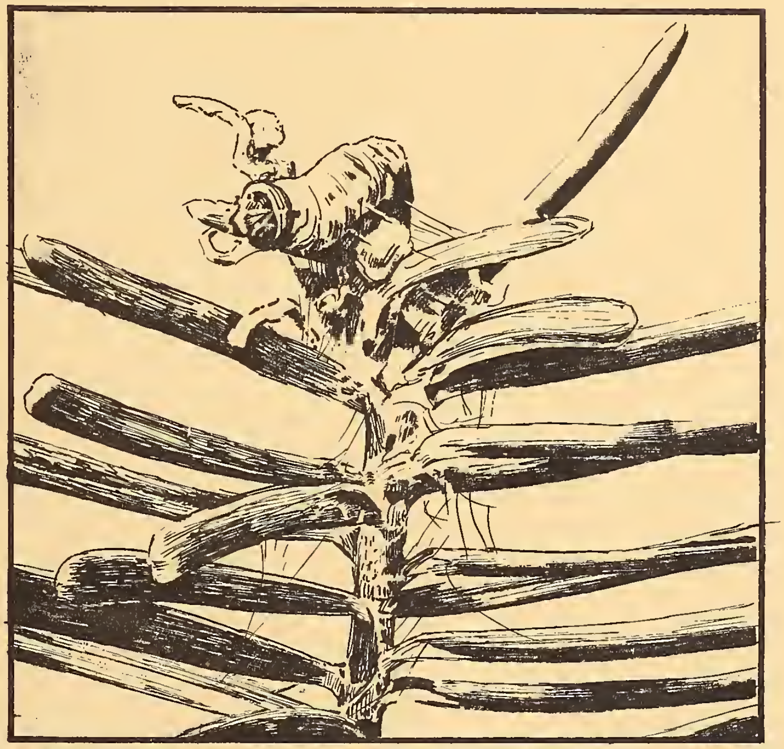

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FOREST INSECT AND DISEASE CONDITIONS IN MONTANA

1981

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Report No. 82-2

March 1982

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INTRODUCTION

In 1980 and 1981, forest insect and disease conditions in the Northern Region were reported on a State-by-State basis. This report covers damage on all ownerships (Federal, State, and private) within Montana. It was prepared by USDA Forest Service, Cooperative Forestry and Pest Management; and Montana Department of State Lands, Division of Forestry. A similar report covering Idaho has been published by the USDA Forest Service and Idaho Department of Lands.

This report is a historical documentation of insect and disease outbreaks in forested areas of Montana. This information can be used to show trends of forest pests and may be helpful in making predictions of the longevity of outbreaks. Land managers and the public can use this information to determine where they can direct their efforts to reduce losses from the pests or where they have to put devastated forests back into production.

CONDITIONS IN BRIEF

The mountain pine beetle continues to be the most destructive forest insect in Montana in all species of pines. Epidemics and outbreaks are present in all National Forests, both National Parks, BLM lands, and Indian Reservations. More than 2.4 million acres of pines are infested. Tree killing by the Douglas-fir beetle increased on six National Forests and Glacier National Park. Damage was most severe southeast of Coram, Montana. A spruce beetle outbreak is developing in western Montana where more than 3,530 acres of all ownerships are infested. Greatest tree kill is within the Flathead National Forest boundaries. A small outbreak of the western pine beetle was found in the Swan Valley. The western balsam bark beetle continues to be a chronic pest in subalpine fir stands on four National Forests and in Glacier National Park. Pine engraver increased in the Northern Cheyenne Indian Reservation. The western spruce budworm is still the major defoliator in Montana where acres of visible defoliation decreased from 974,000 to 932,000 acres from 1980 to 1981. However, defoliation increased by 190,473 acres within the Beaverhead National Forest area. The Douglas-fir tussock moth defoliated several ornamental blue spruce near Polson, which was the first indication of its presence in the State since 1976. Defoliation by the larch casebearer decreased in 1981. The outbreak of a new budworm species west of Trout Creek subsided this year. Ponderosa pine needle miner populations increased around Arlee on the Flathead Indian Reservation. Lodgepole terminal weevil damage increased in plantations on the Beaverhead NF area. Aphid and June beetle damage increased in Scotch pine Christmas tree plantations in the Big Fork area.

Root diseases are the most damaging tree diseases in Montana. Five of them cause serious damage and some are widespread. Armillaria root rot is most destructive in the western half of Montana. Brown cubical root and butt rot is extensive in Douglas-fir in areas on the Lolo, Lewis and Clark, Helena, and Bitterroot National Forests, and in ponderosa pine on the Custer NF. Black stain is being found with increasing frequency as a precursor to Armillaria centers and bark beetle attacks. Annosus root rot was found in several stands of subalpine fir, Douglas-fir, and ponderosa pine. Laminated root rot is common on Douglas-fir within the Clark Fork River drainage. Dwarf mistletoe is causing significant growth losses in Douglas-fir, western larch, and lodgepole pine in western Montana and in lodgepole pine east of the Continental Divide. Annual growth reduction in M ft^3 is 16,963.7 for lodgepole; 8,888.0 for Douglas-fir; and 7,380.0 for western larch. Western larch foliage diseases caused severe defoliation throughout western Montana. Lodgepole pine needle cast was extensive statewide. Blister rust resistant stock is resulting in greatly improved survival of white pine seedlings. Comandra rust in lodgepole pine was common on the Ennis Ranger District of the Beaverhead NF and west of Kalispell on Champion lands. Western gall rust on pines is common; but it caused patches of mortality in Scotch pine Christmas trees north of Flathead Lake. A larch canker disease was active in a stand west of Kalispell. Stem decays caused considerable volume losses statewide. Armillaria is a leading killer of seedlings. Frost damage was widespread and "red belt" was evident east of the Continental Divide.

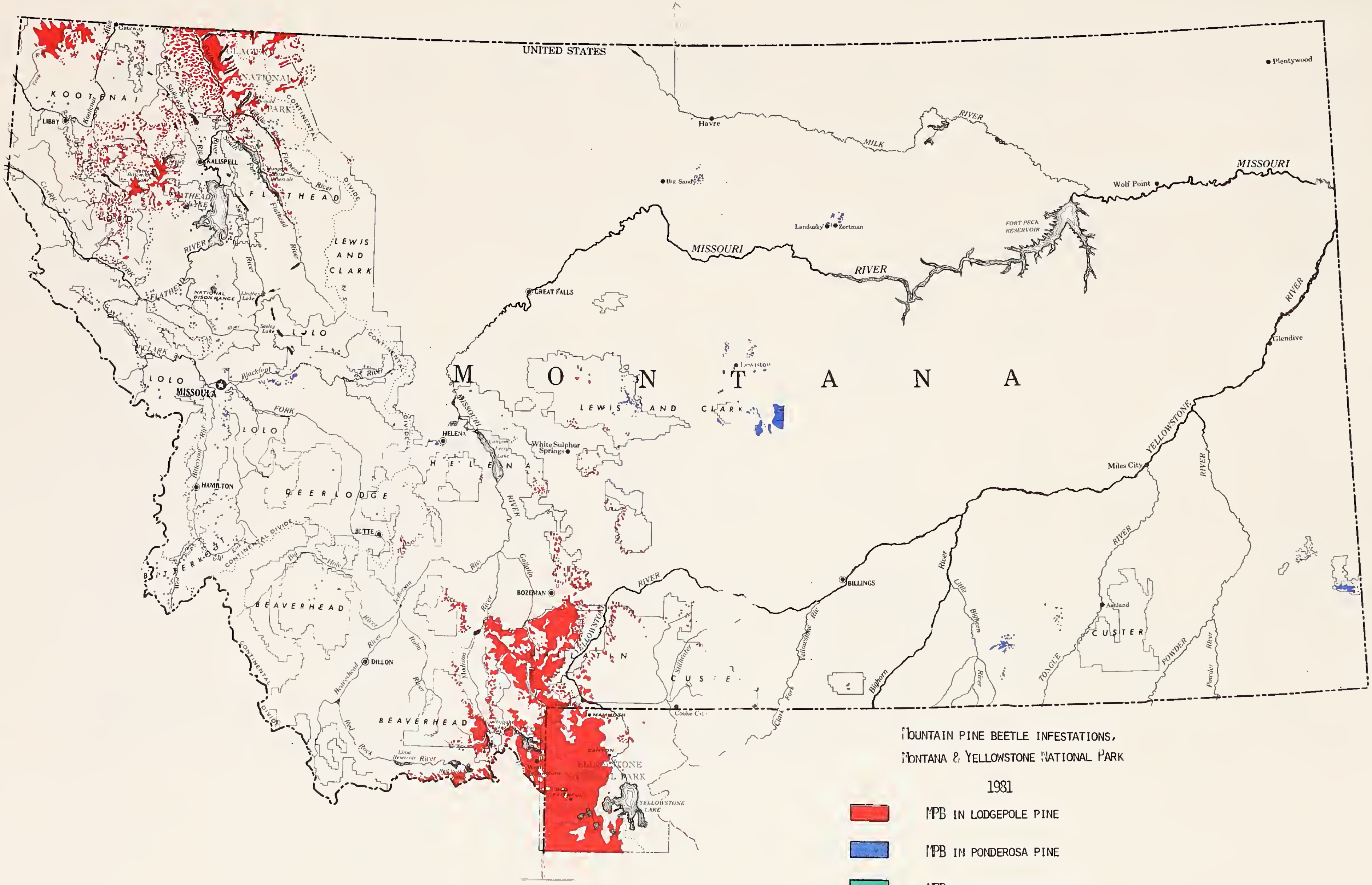
INSECTS

BARK BEETLES

Mountain Pine Beetle

The mountain pine beetle continues to be the most destructive forest insect in Montana. A decline in infestation intensity occurred in many areas, but expanses of infestation persist on the Beaverhead, Custer, Gallatin, Flathead, Lewis and Clark, Lolo, and Kootenai National Forests; Glacier and Yellowstone National Parks; the Blackfoot, Crow and Fort Belknap Indian Reservations; and on BLM land in the Centennial Mountains. Adjacent State and private lands are likewise affected. Less extensive infestations occur elsewhere, notably within Bitterroot, Deerlodge, and Helena National Forests and the Flathead, Northern Cheyenne, and Little Rocky Boy's Indian Reservations (see map on following page).

Most mortality occurs in lodgepole pine. Statewide, nearly 2 million acres of federally administered lands in this type were infested in 1981 (table 1). Another 350,000 acres of State and private lands were affected (table 2). Ponderosa pine type infested included more than 30,000 acres of Federal lands and another 50,000 acres of State and private lands. Mortality continued to a lesser degree in whitebark and western white pine type.



Mountain Pine Beetle Infestations, Montana & Yellowstone National Park

1981

Table 1.--Acres of mountain pine beetle infestation on Federal lands in Montana, 1980 and 1981.

Ownership	1980				1981				
	LPP[1]	WBP	PP	WWP	LPP	WBP	PP	WWP	Trend
Beaverhead NF	73,538	10,410	-	-	119,565	530	-	-	Decreasing
Bitterroot NF	600	-	735	-	1,180	-	830	-	Static
Custer NF	-	600	-	-	400	1,576	7,940	-	Static
Deerlodge NF	1,495	-	-	-	880	40	-	-	Static
Flathead NF	122,637	93,525	30	1,020	108,622	7,100	-	6,276	Static
Gallatin NF	323,010	14,824	-	-	455,985	-	-	-	Static
Helena NF	776	185	55	-	340	30	-	-	Static
Kootenai NF	83,996	-	320	10	108,755	120	300	-	Increasing
Lewis & Clark NF	50	25	6,300	-	250	120	10,262	-	Static
Lolo NF	13,840	-	330	-	10,030	-	250	-	Decreasing
Glacier NP	276,266	14,997	-	1,125	189,350	740	500	1,300	Decreasing
Yellowstone NP	821,300	-	-	-	964,878	-	-	-	Static

Table 1 continued

Ownership	1980				1981				
	LPP1/	WBP	PP	WWP	LPP	WBP	PP	WWP	Trend
Blackfeet IR	11,584	-	-	-	5,168	-	-	-	Decreasing
Crow IR	-	-	4,290	-	-	-	4,090	-	Static
Flathead IR	80	-	120	-	-	-	200	-	Static
Fort Belknap IR	-	-	1,890	-	-	-	1,620	-	Static
N. Cheyenne IR	-	-	300	-	-	-	10	-	Static
Rocky Boy's IR	10	-	50	-	-	-	5	-	Static
BLM	256	-	650	-	18,414	-	4,425	-	Static
TOTALS									
National Forests	619,942	119,569	7,700	2,155	806,007	9,516	19,582	6,276	
National Parks	1,097,532	14,997	-	-	1,154,228	740	500	1,300	
Indian Reservations	11,674	-	6,650	-	5,168	-	5,925	-	
BLM	14,256	10,620	650	-	18,414	-	4,425	-	
All Federal	1,743,404	145,186	15,070	2,155	1,983,817	10,256	30,432	7,576	

1/ LPP = lodgepole pine; WBP = whitebark pine; PP = ponderosa pine; WWP = western white pine

Table 2.--Acres of mountain pine beetle infestation on State and private lands in Montana, 1980 and 1981.

Reporting area	1980				1981				Trend
	LPP	WBP	PP	WWP	LPP	WBP	PP	WWP	
Beaverhead NF	36,507	11,165	--	--	62,840	30	--	--	Increasing
Bitterroot NF	--	--	1,235	--	--	--	350	--	Decreasing
Custer NF	--	--	--	--	90	--	400	--	Increasing
Deerlodge NF	50	--	--	--	--	--	--	--	Decreasing
Flathead NF	85,980	3,050	977	--	65,637	--	300	--	Decreasing
Gallatin NF	221,089	5,143	--	--	180,537	--	140	--	Decreasing
Helena NF	100	--	--	--	--	--	--	--	Decreasing
Kootenai NF	22,523	--	375	--	33,080	--	660	--	Increasing
Lewis & Clark NF	60	--	37,490	--	--	--	43,546	--	Static
Lolo NF	12,880	--	879	--	8,165	--	670	80	Decreasing
Garnets	--	--	12,222	--	--	--	3,733	--	Decreasing
Judith River	--	--	2,994	--	--	--	540	--	Decreasing
Swan River	30	--	180	2,350	--	--	--	600	Decreasing
Stillwater	10,035	--	--	--	1,000	100	--	1,270	Decreasing
Thompson River	14,421	--	--	--	6,765	--	60	--	Decreasing
Totals	403,674	19,358	56,352	2,350	358,114	130	50,399	1,950	Decreasing

Silvicultural manipulation of high hazard lodgepole stands still holds the most promise for keeping beetle populations and subsequent tree mortality in check. Table 3 shows acres treated and volumes by ownership in an effort to reduce losses to the beetle.

Table 3.--Lodgepole volume removed in response to mountain pine beetle (includes sanitation, salvage and removal of high risk green) 1973-1981.

Ownership	Acres treated	Volume removed (MMBF)
Federal:		
Beaverhead NF	4,600	54.2
Flathead NF	8,000	124.4
Gallatin NF	15,700	121.1
Kootenai NF	26,800	214.4
Lolo NF	3,142	18.6
BLM	30	0.6
Private:		
Burlington Northern	10,752	70.2
Champion International	10,300	82.0
St. Regis Paper	5,500	24.5
State and other private	15,000	72.6
TOTAL	99,824	782.6

Beaverhead National Forest Area

Aerial detection surveys showed an increase of infested acres over those in 1980 from about 73,000 to more than 119,000 (table 1). Subsequent ground checking showed mortality was generally less in 1981.

The infestation still is confined largely to the Madison RD on the east side of the Gravelly Range and the west side of the Madison Range from about Saddle Mountain on the south to Ennis Lake on the north. West of Ennis Lake, the infestation increased along the southeastern portion of the Tobacco Root Mountains in 1981. Throughout the infested area both lodgepole and whitebark pines are being killed.

Ground surveys showed a generally decreasing trend in new attacks. Twelve survey areas scattered throughout the District showed an average of 6.9 new attacks per acre compared to 17.8 attacks per acre in 1980. While these data cannot be extrapolated to represent District-wide figures, they do represent trends for areas surveyed. Based on these surveys, we believe the beetle infestation might be declining in some areas. Localized mortality may increae in acres as long as susceptible host exists.

Infested acreage on private lands increased by about 70 percent. Infestations spread mainly in the Centennial Mountains south of Red Rock Lakes.

Bitterroot National Forest Area

Ponderosa pine faders occur throughout the Forest in 1- to 5-tree groups. Overall, there appears to be a slight increase over 1980--particularly along the East Fork of the Bitterroot River, Sula RD.

On the West Fork RD [1/], small scattered groups of ponderosa pine faders occur along the West Fork Bitterroot. State and private acres infested decreased substantially, although activity continued in the 8-Mile Creek drainage near Florence and near the Trapper Creek Job Corps Center.

Custer National Forest Area

Notable increases in ponderosa pine faders occurred on the Sioux Division in 1981. Nearly 8,000 acres are infested in the Long Pines Unit between Stormy Butte, Bell Tower Butte, and Capitol Rock, west of Camp Crook, SD. Other small infestations occur near Ekalaka Park, south of Ekalaka. Ground surveys indicated that the infestation may have peaked since few new attacks were found. It appears the infestation was augmented by severe dry conditions for the past several years.

On the Beartooth Division, approximately 1,500 acres of high elevation whitebark pine are infested near Lone Creek Guard Station south of Red Lodge. This infestation has been static for several years. Smaller groups of whitebark faders occur in the Pryor Mountains east of Bridger.

Small groups of lodgepole pine faders totaling 400 acres occur on the northwest part of the Beartooth RD near Fishtail Butte and Limestone Butte. These groups were not seen in 1980, indicating the infestation may be building in susceptible host type and should be monitored closely in future years.

[1/] Most beetle activity on the West Fork RD occurs within Idaho.

Infestations on State and private lands totaled 490 acres. Activity increased significantly in ponderosa pine in the Lone Pine area southeast of Ekalaka and also continued on the Crow Indian Reservation. Whitebark and lodgepole pines have been killed west of Red Lodge.

Deerlodge National Forest Area

Forest-wide, acres of lodgepole pine mortality declined from 1,400 acres in 1980 to 900 acres in 1981. Most mortality occurred on the Jefferson RD. Faders decreased in the Bull Mountains, around Elder Creek Campground, and between Delmoe Lake and Homestake Pass. Several new groups of faders were observed in the South Boulder River drainage south of Whitehall.

The Forest could experience greatly intensified infestations in the next several years. About 30 percent of 400,000 acres of lodgepole pine sawtimber is considered highly susceptible to the beetle.

Flathead National Forest Area

Infested lands decreased in lodgepole pine type from 122,000 acres in 1980 to 108,000 acres in 1981; whitebark pine decreased from 93,000 to 7,100 acres 2/ and increased in white pine type from 1,000 to more than 6,200 acres (table 1). Forest-wide the beetle infestation is static to increasing on all Districts except Glacier View, where beetle populations have nearly depleted susceptible host type.

On the Glacier View RD ground evaluations showed a higher number of new attacks in 1981 than in 1980 on 4 of 18 areas. Successfully attacked trees declined for the third successive year totaling only 2.1 trees/acre.

Some localized tree mortality will continue, but the infestation should continue to decline throughout the District.

Ground data from four of seven areas of lodgepole pine type on the Hungry Horse RD showed an increasing trend. Average of the seven areas totaled 6.3 trees/acre killed in 1981 compared to 3.3 trees/acre killed in 1980. The bulk of the infestation continues to be on the east side of Hungry Horse Reservoir and the northern portions of the District. Infestation is predicted to increase in most areas. Infestation in white pine remained static in 1981--approximately nine infested trees/acre. Mortality in western white pine on both sides of Hungry Horse Reservoir will probably continue at about the same level in 1982.

2/ This decrease may not be as dramatic as it seems. In 1980, efforts were made to separate lodgepole and whitebark types entirely during aerial surveys. In 1981 they were not.

Surveys of 29 areas on the Tally Lake showed mortality in lodgepole pine stands has increased steadily since 1978, but has not increased at the rate first predicted. Infested acres decreased from about 13,000 in 1980 to slightly less than 10,000 in 1981. Most beetle activity was in the southern part of the District near Ashley Lake, where the infestation south of McGregor Lake is increasing markedly. About one-third of the 29 areas surveyed showed new attacks in 1981. Averages for the 29 areas were 7.0 new attacks/acre in 1980, and 14.2 in 1981.

We anticipate the infestation will continue its spread through susceptible lodgepole pine stands.

Infestations on the Swan Lake and Spotted Bear RD's continued at relatively low levels in 1981. Surveys indicated no new attacks on the Spotted Bear plots, but increasing trends on Swan Lake District. With expanding beetle populations near both Districts, infestations likely will increase.

Since the current outbreak began, infestation in lodgepole stands on State and private lands decreased--from 85,980 acres in 1980 to 65,637 in 1981. Tree killing continued to decline in the Coal Creek State Forest, along the North Fork of the Flathead, and on the Stillwater State Forest due to depletion of hosts and an aggressive salvage program including harvesting of uninfested susceptible green trees. Though beetle activity declined over much of the Flathead area, infestations in the McGregor Lake, Little Bitterroot Lake, and Ashley Lake areas continued to spread. Recent outbreak areas north of Columbia Falls and Whitefish also increased in size and intensity.

Gallatin National Forest Area

Forest-wide, acres on which faders occurred in 1981 increased substantially over 1980. About 456,000 acres were infested in 1981 compared to 323,000 in 1980. However, ground surveys indicated the infestation on the west side of the Forest is declining. Beetle-caused mortality is increasing in the southern portion of the Gallatin Canyon, east and north of Bozeman, and north of Gardiner. Throughout the Gallatin Canyon and the Hebgen Lake RD, the infestation is waning.

On the Bozeman-Gallatin RD, some areas are still experiencing high mortality. Some ground plots had large numbers of new attacks in 1981. Plots in Bozeman Creek, Cinnamon Creek, and Porcupine Creek drainages showed increasing trends. Of 18 other areas throughout the District, most show a decline in attacked trees. Averages for 21 areas showed 7.2 trees/acre attacked in 1981 and 17.5 in 1980.

Surveys on the Livingston RD showed 7.1 trees/acre killed in 1981 and 17.5 in 1980. Of nine areas surveyed, only two showed increasing trends--Big Draw and Suce Creek.

Of 11 areas on the Hebgen Lake RD, only one showed more new attacks in 1981 than in 1980. Average of the 11 plot areas showed new attacks to be less than half of those found in 1980: 5.1 trees/acre in 1981 and 10.7 in 1980.

Few areas were surveyed on the Big Timber and Gardiner Districts, but those surveyed showed a decrease from 1980. We expect this decrease to be temporary because much susceptible host type remains on these Districts.

Infestations in lodgepole pine on State and private lands declined from 221,089 acres in 1980 to 180,537 acres in 1981. Most of this decrease was in the Gallatin Canyon. Infestations continued to intensify in Hyalite Canyon, Bear Canyon, east towards Livingston, northward in the Bridger Mountains, and to the south and west of Bozeman near the mouth of Gallatin Canyon.

Helena National Forest Area

Mountain pine beetle continued to be quite minor in 1981. There were a few scattered ponderosa pine faders north of Lincoln on the Lincoln RD. Small, 5- to 10-tree groups occurred in several drainages southeast of Helena. Small groups of lodgepole pine faders were observed.

The beetle continued to kill lodgepole pines along tributaries of Deep Creek east of Townsend. Several scattered groups of faders totaled about 240 acres. Tree mortality is expected to remain static.

Kootenai National Forest Area

Infestation increased from 84,000 acres in 1980 to nearly 109,000 in 1981. Most Districts showed increases in infested acres. The most dramatic increase was on the Fisher River RD where areas of faded lodgepole pine nearly doubled from 13,600 acres in 1980 to 25,700 in 1981. Infestation on the Yaak RD increased from 64,000 to more than 74,000 acres.

Infestation on the Fisher River RD averaged 39 newly attacked trees/acre in 1981--up from 12.4/acre in 1980. The greatest single increase occurred in and around McGregor Lake Campground where new attacks averaged 116/acre in 1981.

Surveys on the Yaak RD showed increasing beetle populations at six of eight locations. Infestation in the lower portions of the Yaak River drainage is now spreading northeastward into the upper reaches of the drainage. Plots near Bunker Hill Creek, Caribou Creek, and East Fork Yaak River showed a fourfold increase in new attacks per acre since 1980. Averages for those areas were 37 attacks/acre, compared with eight attacks/acre in 1980. We anticipate the epidemic will continue its advance on that part of the District.

Other portions of the Forest are experiencing some mortality of a scattered nature. An infestation in Gold Creek drainage on the Rexford

RD expanded in 1981 as did one on the Fortine RD along Sunday Creek. Scattered ponderosa pine faders also occurred, but no major infestation is apparent. Forest-wide mortality in lodgepole pine and ponderosa pine is expected to spread in 1982.

Beetle infestations on State and private lands in the Kootenai National Forest increased from 22,898 acres in 1980 to 33,750 acres in 1981. Most damage was west of Little Bitterroot Lake, north of McGregor and Thompson Lakes, and along the Fisher River.

Lewis and Clark National Forest Area

Ponderosa pine mortality occurred on more than 10,000 acres in 1981, an increase of nearly 4,000 acres since 1980. Much of the mortality is scattered with the highest concentration near the Judith Guard Station, Stanford RD. Numbers of faded trees were markedly higher in 1981 than in 1980.

On the White Sulphur Springs RD, lodgepole pine mortality increased in the Boulder Creek and Warm Springs Creek areas. This infestation is developing and only a few hundred trees have been killed.

Small groups of lodgepole pine faders were on the Teton RD near Slippery Hoof Lake. This infestation should be monitored closely because of the large expanses of lodgepole pine.

Infestation on State and private land increased from 37,490 acres in 1980 to 43,546 acres in 1981. The increase was mainly southeast of Lewistown in the Little Snowy Mountains and the Flatwillow Creek drainage. Though area infested increased, intensity remained virtually the same, with only scattered trees or small groups being killed over most of the area. Infestations south of Lewistown have virtually ended. Declines were also noted in the Judith and North and South Moccasin Mountains north of Lewistown where the infestation dropped from 2,994 acres in 1980 to only 540 acres in 1981.

Lolo National Forest Area

Mortality decreased in both intensity and scope throughout the Forest in 1981. A marked decrease in infested acres occurred within the Thompson River drainage on the Plains RD. We expect the infestation will continue its decline in 1982.

On the Plains RD, where the beetle infestation has been concentrated for the past several years, the infestation decreased from 12,600 acres in 1980 to 9,400 this year. Surveys throughout the Thompson River drainage showed declining beetle attacks in more than half of them. Some increases in new attacks per acre occurred in the northern part of the drainage near Richards Peak. Averages for the areas were 11.2 new attacks/acre in 1981 compared to 14.0 in 1980. As more stands are placed under management and more susceptible timber is removed, beetle populations will continue to decrease.

Scattered lodgepole and ponderosa pine mortality occurred on the Superior, Missoula, and Ninemile Districts. No major areas of infestation in ponderosa pine exists. Infestations in lodgepole pine on State and private lands in the Thompson River area covered 6,765 acres in 1981, compared to 14,421 acres in 1980. Activity will probably continue to decrease due to depletion of susceptible hosts by beetles and logging in infested stands.

Glacier National Park

Infestation continued to decrease in intensity on the west side while increasing on the east. The infestation decreased from 276,000 acres in 1980 to 190,000 in 1981. Most lodgepole pine stands which have been heavily infested from McDonald Lake to the U.S.-Canada border, now consist of snags and older dead. However, the epidemic is still strong in the northwest corner. Surveys located in the western part of the Park showed new attacks in only 2 of 12 areas. One was near the west entrance, where new attacks/acre declined from 33 in 1980 to only 4 in 1981, the other was north of Essex. No new attacks occurred in the other 10 areas.

On the Park's east side, the infestation in the Belly River drainage is increasing in intensity. Infested acres have not increased significantly but the numbers of faders are markedly higher than in 1980. Much the same has happened around Lake Sherburne and Saint Mary Lake. Infestation around Waterton Lake decreased in intensity over the past year. Data has not been collected from the east side of the Park. However, the infestation is so new we believe it will increase for the next few years.

Yellowstone National Park

Infested acres increased in 1981. Nearly 965,000 acres are now infested, compared to 821,000 acres in 1980. Most notably, the infestation has expanded to nearly encompass all stands at Heart Lake and Lewis Lake in the south, and has spread to Mammoth and Tower Falls in the north. Surveys in 19 locations scattered throughout infested areas showed increasing numbers of new attacks, but averages from all areas showed a slight decrease. Ten new attacks/acre were recorded in 1981 compared to 17 in 1980. Though the infestation is building in some areas to the north and east, it is decreasing in others.

Blackfeet Indian Reservation

The part of the Reservation adjacent to the northeastern edge of Glacier NP has experienced an increasing beetle infestation the past several years. Acres infested in 1981 decreased to less than half of those in 1980--slightly more than 5,100 acres in 1981 compared to more than 11,400 in 1980. A few areas are increasing along Kennedy Creek and Otatso Creek. In the northwest corner of the Reservation, fewer faders occurred in 1981 than in the previous year.

Crow Indian Reservation

Infested acres of ponderosa pine type remained virtually unchanged in 1981--4,200 acres in 1980, just over 4,000 in 1981. The location has changed somewhat. In the southern part of the Reservation, along Youngs Creek, no faders occurred in 1981. More faders were noted along the tributaries of Corral Creek than in 1980. Surveys in nine areas showed no increasing trends in new attacks. Six of the nine showed no new attacks at all. Only along Moonshine Creek, Spring Creek and near Wolf Mountain did we find new attacks in 1981.

Flathead Indian Reservation

Only small scattered groups of ponderosa and lodgepole pine faders occurred in 1981. Five- to 10-tree groups were widely scattered throughout the ponderosa pine type on the western portion of the Reservation. Some small groups of lodgepole pine faders were in the southern portion along North Fork and South Fork Valley Creek. Only occasional faders occurred on the east side of the Reservation. In the northeastern corner east of Blue Bay, some scattered lodgepole pine mortality occurred. No noticeable increases are expected in 1982.

Fort Belknap Indian Reservation

The infestation changed little from 1980. Last year the infestation covered almost 1,900 acres; in 1981, slightly more than 1,600 acres. Most infested acres are within drainages of Beaver Creek and Bear Gulch. A few scattered groups were along Lodge Pole Creek and others near Landusky. This infestation will likely remain static in 1982.

Northern Cheyenne Indian Reservation

Ponderosa pine mortality decreased markedly in 1981. About 300 acres were affected in 1980, compared to 10 acres, represented by widely scattered groups, in 1981. Many formerly susceptible stands on the Reservation have been placed under management preventing outbreak development.

Rocky Boy's Indian Reservation

Though ponderosa pine mortality is widely scattered, the area affected has increased in the last year. Most groups of killed trees consist of less than 10 trees, scattered along the tributaries of Muddy Creek. One 30-tree group occurred north of Sawmill Ranger Station. Other small groups were noted along Big Sandy Creek. Scattered tree killing probably will continue in 1982.

Bureau of Land Management

The greatest amount of beetle-caused mortality continues to be in the Centennial Valley south of Red Rock Lakes. The infestation is expanding in lodgepole pine and whitebark pine types. In 1980, more than 14,000 acres were affected. That figure increased to almost 18,500 acres in 1981. We believe the infestation will begin to subside soon due to host depletion.

Scattered ponderosa pine mortality is evident on BLM lands in the Judith Mountains northeast of Lewistown. Infested acres including State and private lands total more than 500.

Scattered ponderosa pine faders continue to occur on all ownerships in the Garnet Mountains east of Missoula. Infested area totaled almost 4,000 acres in 1981--down from 12,000 acres in 1980. While some lodgepole pine faders occurred there in 1980, there were none in 1981.

Spruce Beetle

The last major outbreak in Montana lasted from 1966 to 1970 and was confined to overmature Engelmann spruce stands on the Flathead and Kootenai National Forests. During 1981, reports from State and National Forests in western Montana indicated increased spruce beetle activity, and subsequent aerial surveys showed damage was widespread. Beetle populations multiplied in windthrow and other damaged spruce during 1978-79 and the past two mild winters were favorable for brood survival.

Greatest tree kill occurred within the Flathead National Forest boundaries in the North Fork Flathead River, Stillwater River, and Swan River drainages (fig. 1). More than 3,350 acres of spruce on all land ownerships were infested in these drainages (tables 4 and 5.) About 1,600 acres of spruce are infested on State and private lands in the Stillwater, Coal Creek, and Swan River State Forest areas. The most severe damage occurred in Stryker Basin, Herrig Basin, near Cyclone Lake, and in the drainages of Swift, Russky, Swede, Antice, and Red Meadow Creeks and off the Mount Marston road in the Stillwater State Forest, and also along Coal Creek in the Coal Creek State Forest (table 6). Infestations are occurring mostly in centers of mature and overmature spruce along creek bottoms and in the higher basins. In some stands along the North Fork Flathead River, trees killed per acre during 1979-81 ranged from 0 to 37. Groups of killed spruce were also detected in Glacier National Park.

Several spruce stands on the Kootenai National Forest are infested. These were along the Whitefish Mountain Range and south of Fortine. In the Ten Lakes Scenic Area, more than 250 spruce faders occurred.

On the Flathead Indian Reservation, groups of 1981-attacked spruce trees were scattered through stands along the northern portion of the Mission Range northeast of Polson. The largest group contained about 10 trees.

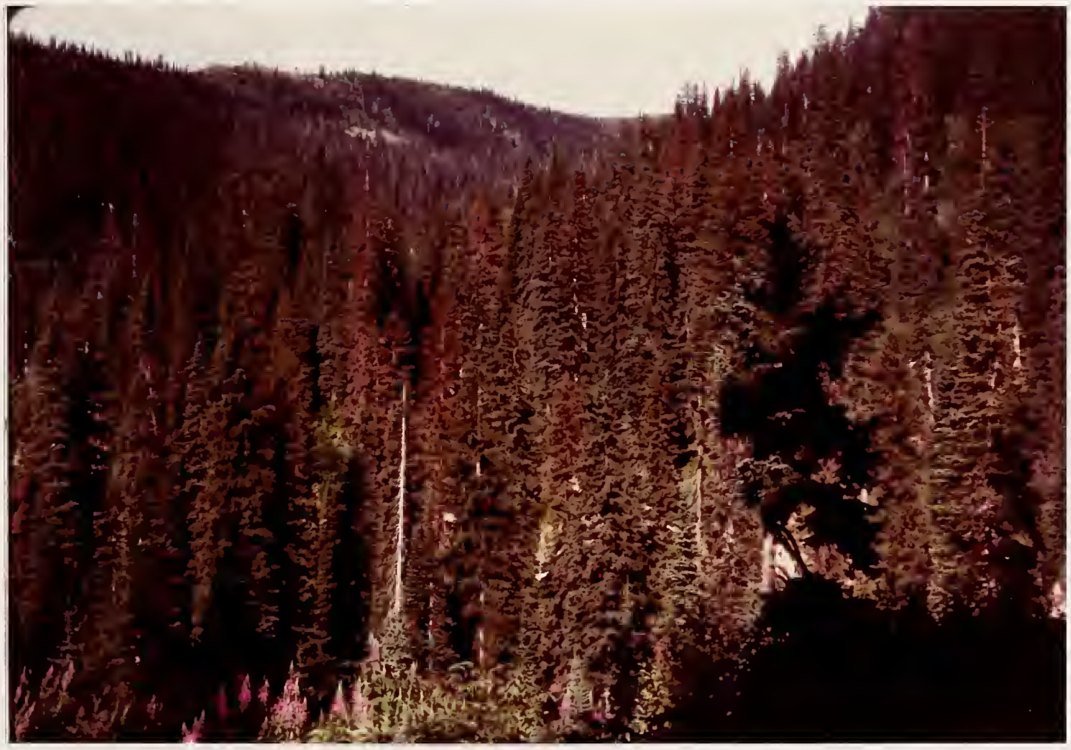


Figure 1.--Fading crowns on spruce trees infested by the spruce beetle.

Douglas-Fir Beetle

Tree mortality increased on lands of all ownerships within the boundaries of the Beaverhead, Deerlodge, Flathead, Gallatin, and Kootenai National Forests and within Glacier National Park from 1980 to 1981 (tables 4 and 5). About 7 acres were also infested on the Lolo National Forest (table 5).

Damage was most severe on the Flathead NF southeast of Coram, Montana, and along the east side of the Swan Valley. In the Coram area, 155 trees were killed, and in the Swan numerous small groups of 2-15 trees were infested. These trees had extensive infections of brown cubical root and butt rot. In most Douglas-fir stands there appears to be a relationship between root rots and Douglas-fir beetle infestations.

On the Gallatin NF damage was concentrated in the two forks of the Boulder River drainages where about 100 trees were attacked. Damage was minor on the other National Forests. About 75 trees were killed that had been weakened from continuous heavy budworm defoliation south of Ennis on the west side of the Madison River.

Western Pine Beetle

Epidemics are rare in ponderosa pine stands in Montana. Commonly it attacks single, decadent, old trees, most of which have been hit by lightning, or groups of pines that have been top killed by *Ips* beetles. However, an outbreak that probably started after the drought of 1977 is active in a ponderosa pine stand in the Swan Valley northeast of Condon. More than 200 ponderosa pine of all size classes have been killed in the past 4 years. Probable factors which favor continuation of this infestation are too many stems per acre, a black stain root disease in many of the ponderosa pine, trees with broken tops, and "high-risk" pines with poor crowns.

Western Balsam Bark Beetle

About 2,285 acres of subalpine fir were infested in 1980 and 1981. Damage was mainly in stands on the Beaverhead, Flathead, Gallatin, and Lolo National Forests and in Glacier National Park (tables 4 and 5). Infestations are chronic in these areas and damage occurs consistently in the same stands. The following tabulation indicates areas that are persistently infected:

Reporting area	Areas containing chronic damage
Beaverhead NF	Gravelly Range; Centennial Valley; Tobacco Root Mountains
Flathead NF	Middle Fork Flathead River; west side North Fork Flathead River; west side Swan Valley;
Gallatin NF	West side Gallatin River; Hebgen Lake Ranger District; west side Yellowstone Valley
Helena NF	Big Belt Range; Elkhorn Range
Lewis and Clark NF	Little Belt Mountains
Lolo NF	Bitterroot Range
Glacier NP	Along east side Continental Divide
Yellowstone NP (Wyo.)	South, east, and northeast of Yellowstone Lake

Incidence of root diseases, overstocking and overmaturity, coupled with added stress from drought, may contribute to population buildups by western balsam bark beetle in these stands.

Pine Engraver

There was an increase in pine engraver damage from 1980 to 1981 on Federal, State, and private lands on the Bitterroot and Lolo National Forests. However, greatest tree mortality in ponderosa pine stands occurred within 1,319 acres on the Northern Cheyenne Indian Reservation (tables 4 and 5). This outbreak resulted from large volumes of logging slash.

Areas on the Bitterroot NF that contained the most pine engraver beetle damage were in the Selway River drainage, West Fork Bitterroot River, and along the west side of the Bitterroot Valley. About 364 ponderosa pines were killed in those areas. On the Lolo NF, groups of 2-30 trees were killed, but these groups were widely scattered throughout the ponderosa pine areas. More than 505 trees were attacked.

Table 4.--Acres of bark beetle infestations (other than mountain pine beetle) on State and private lands in Montana, 1981.

Reporting area	Douglas-fir beetle	Western balsam bark beetle	Pine engraver	Spruce beetle
Beaverhead	--	390	--	--
Bitterroot	--	--	80	--
Flathead	8	--	--	50
Gallatin	80	--	--	--
Kootenai	60	--	--	--
Lolo	--	--	80	--
Stillwater	--	--	--	1,400
Swan River	10	--	--	--
Total	158	390	160	1,570

Table 5.--Acres of bark beetle infestations (other than mountain pine beetle) on Federal lands in Montana, 1981.

Ownership	Douglas-fir beetle	Western balsam bark beetle	Pine engraver	Spruce beetle
Beaverhead NF	--	865	--	--
Bitterroot NF	--	--	170	--
Deerlodge NF	50	--	--	--
Flathead NF	320	100	--	--
Gallatin NF	312	350	--	--
Kootenai NF	--	--	--	--
Lolo NF	7	80	122	--
Glacier NP	50	500	--	--
Northern Cheyenne IR	--	--	1,319	--
BLM	20	--	--	--
Total:				
National Forests	689	1,395	292	2,080
National Parks	50	500	--	--
Indian Reservations	--	--	1,319	--
BLM	20	--	--	--
All Federal	759	1,895	1,611	2,080

Table 6.--Spruce beetle mortality in nine locations on the Stillwater and Coal Creek State Forests, 1981.

Area		Undamaged spruce stand	Current attack	Last year's attack	Older attack
Coal Cr., sec. 28	TA	72.4	0	3.1	3.8
	BFA	21,079.3	0	1,200.4	2,752.3
Coal Cr., sec. 29 & 30	TA	64.8	2.4	1.3	4.8
	BFA	12,054.4	2,601.2	802.4	5.191.9
Cyclone Lake	TA	66.7	2.2	1.5	4.2
	BFA	14,449.7	812.6	1,424.7	625.5
Stryker, sec. 25	TA	44.9	7.1	9.0	5.6
	BFA	13,369.6	4,880.4	5,605.9	3,188.7
Stryker, sec. 26	TA	48.3	12.2	5.6	2.7
	BFA	12,748.9	5,031.7	1,760.6	2,077.3
Herrig Basin	TA	59.3	7.0	3.4	2.2
	BFA	12,702.9	2,408.8	1,097.9	634.3
Red Meadow	TA	101.5	1.0	0	6.1
	BFA	20,453.0	833.6	0	467.9
Antice Cr., sec. 4	TA	82.0	0	.7	4.9
	BFA	16,258.3	0	550.4	1,370.0
Swift Cr., sec. 10	TA	86.2	5.6	6.1	1.9
	BFA	21,691.0	2,228.1	2,157.2	1,684.5

TA = Trees per acre

BFA = Board feet per acre

In all stands surveyed, woodpecker feeding on infested trees is very heavy. Woodpecker populations might have built up due to abundant food supplied by the mountain pine beetle epidemic.

Western Spruce Budworm

Western spruce budworm populations declined from previous years (tables 7 and 8), but continue to be a major pest in eastern Montana, portions of western Montana, and Yellowstone NP (see map on page 23).

Table 7.--Acres of aerially visible western spruce budworm defoliation on all ownerships in Montana and Yellowstone National Park in 1980 and 1981.

Reporting area	1980	1981	Change
Beaverhead NF	179,215	369,688	+190,473
Bitterroot NF	3,860	4,330	+ 470
Custer NF	30,910	14,639	- 16,271
Deerlodge NF	27,004	120,715	+ 93,711
Flathead NF	0	7,164	+ 7,164
Flathead IR	0	9,798	+ 9,798
Gallatin NF	510,119	110,308	-399,811
Helena NF	3,630	56,344	+ 52,714
Kootenai NF	0	0	0
Lewis & Clark NF	57,112	60,673	+ 3,561
Lolo NF	7,290	84,701	+ 77,411
Garnet Mountains 1/	29,202	56,353	+ 27,151
Subtotal	848,342	894,713	+ 46,371
Yellowstone NP	125,960	37,240	- 88,720
GRAND TOTAL	974,302	931,953	- 42,349

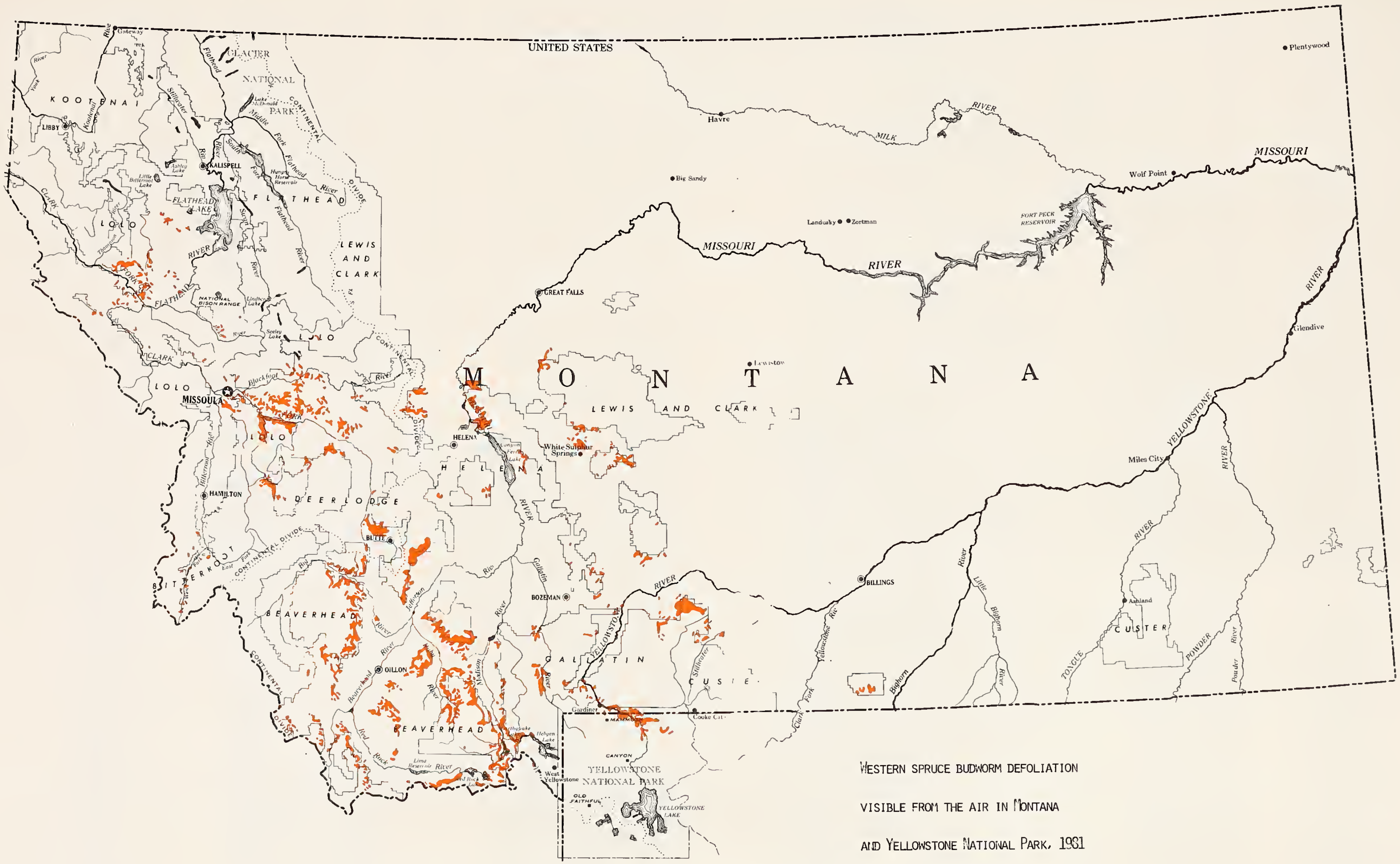
1/ Previously included in the Lolo NF total.

Table 8.--Area of visible defoliation on all ownerships caused by western spruce budworm in Montana and Yellowstone National Park during the past 12 years.

Year	Acres of visible defoliation	Change from previous year
1970	1,807,800	- 729,240
1971	2,532,800	+ 725,000
1972	2,696,760	+ 163,960
1973	1,538,380	- 1,115,380
1974	2,020,873	+ 482,493
1975	2,797,448	+ 776,575
1976	2,558,623	- 238,835
1977	2,979,173	+ 420,550
1978	2,465,520	- 413,653
1979	2,260,577	- 204,942
1980	974,302	- 1,286,275
1981	931,953	- 42,349

Of this 449,209 acres were in State or private ownership. The largest expansion was on the Beaverhead NF where 369,688 acres were defoliated. This was about twice the acreage in 1980. The largest decrease (399,811 acres) was on the Gallatin NF where infestations have persisted for many years. Most of the decline was in the Gallatin Canyon and Bridger Mountains. Defoliation declined in Yellowstone National Park in 1981. Cool, wet conditions during budworm larvae dispersal and early feeding periods were probably responsible in part again in 1981, as they were in 1980, for the lower total acreage of visible budworm defoliation.
A pilot project using a bacteria, Bacillus thuringiensis (Bt), was conducted on the Deerlodge National Forest in June and July to reduce budworm populations.

Silvicultural demonstration areas were established on the Lolo and Gallatin National Forests in 1981 to demonstrate regeneration harvest strategies to reduce budworm damage. Regeneration cuts included shelterwood, overstory removal, partial cuts, and clearcutting.



WESTERN SPRUCE BUDWORM DEFOLIATION VISIBLE FROM THE AIR IN MONTANA AND YELLOWSTONE NATIONAL PARK, 1981

Douglas-fir Tussock Moth

Tussock moth defoliation was not detected in Montana from 1976 to 1980. In 1981, several ornamental blue spruce were defoliated by tussock moth larvae near Polson. Similar defoliation was the first sign of an impending outbreak during the early seventies.

Pheromone traps were placed in 12 permanent plots. Male moths were caught at 11 of them and catches at seven were extremely high compared to previous years. Average moths per trap ranged from 3.0 at Big Arm to 77.8 near Frenchtown. High catches occurred near Frenchtown, Albert Creek, Ninemile Creek, Polson, and Rollins.

Larch Casebearer

Ground observations showed defoliation by the larch casebearer has decreased since 1980. From the air, casebearer feeding could not be distinguished from discoloration caused by two needle diseases on larch. The parasite complex of the larch casebearer was reevaluated in 1981. *Chrysocharis laricinellae* was the most abundant and widespread parasite. *Agathis pumila* was second in abundance but had spotty distribution. *Spilochalcis albifrons* was the most abundant and widespread native parasite, but only accounted for 1 percent of total parasitism. *Mesopolbus* sp., another native, was sometimes third in abundance. All other parasite species, collectively, accounted for less than 1 percent total parasitism.

A New Budworm

This budworm was first discovered north of Wallace, Idaho, in 1978 when it defoliated about 40 acres of mountain hemlock and other conifers. By 1980, it spread onto the Kootenai National Forest west of Trout Creek and defoliated 6,500 acres of mixed conifers. Because of stormy weather and early snows, aerial surveys were not made in the fall to detect 1981 defoliation. However, surveys in outbreak areas revealed no budworms in 1981. There was some evidence of very light feeding early in the summer near Ulm Peak. This outbreak has probably subsided.

Ponderosa Pine Needle Miner

An epidemic of this needle miner started in 1977 on the Flathead Indian Reservation and in the Missoula Valley. About 10,000 acres of ponderosa pine were heavily defoliated that year. The outbreak continued, but decreased in 1978, and by 1979 very little mining occurred. Damage was very light in 1980, but populations increased that summer, and by spring 1981 defoliation was evident in most stands that were infested during 1977. More than 2,500 acres were defoliated in 1981.

Cooley Spruce Gall Aphid

For the past 2 years, abundant rainfall in late spring has produced lush foliage on Douglas-fir trees. These conditions must be favorable to the

Cooley spruce gall aphid because populations were at the highest levels in many years. Some 6- to 8-foot Douglas-fir had 100 percent of their new needles infested.

OTHER INSECTS

Lodgepole Terminal Weevil

Damage to terminals (fig. 2) of lodgepole pine in plantations has increased in Montana. Several plantations in 1981 had a noticeable amount of terminal killing. Some were west of Wisdom and others were southwest of Ennis on the Beaverhead National Forest. Damage by this weevil might be widespread and serious.

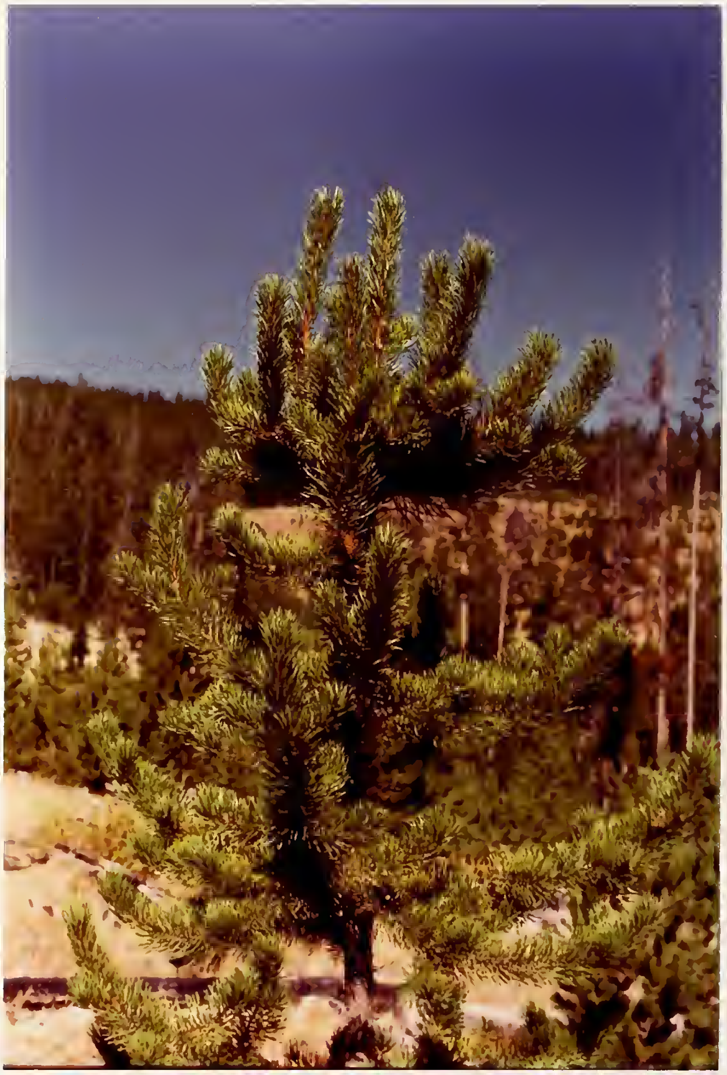


Figure 2.--Bushy terminal growth on lodgepole pine sapling caused by lodgepole terminal weevil feeding.

Pine Bark Aphid

Populations were again high in the spring of 1981 in several Scotch pine Christmas tree plantations in the Bigfork and Kalispell areas. Considerable damage occurred in several plantations. Feeding stunts new growth and can severely affect the shape, form, and appearance of trees. Some trees lost a year's growth because growers were forced to shear the trees very heavily.

Ten-Lined June Beetle

Several Christmas tree plantations were damaged by ten-lined June beetle white grubs in the Bigfork area. Grubs girdled roots of newly planted stock and young established plantations. Some growers reported seedling losses as great as 25-30 percent in plantations as large as 20 acres.

DISEASES

ROOT DISEASE

Root disease continues to be the most damaging of the disease problems in Montana. Most of the large-group mortality caused by root disease has Armillaria root rot associated. Several other root pathogens are also associated with these root disease centers and are often precursors to Armillaria infection.

Scattered single-tree and small group mortality due to root disease (fig. 3) probably accounts for even greater losses than does large group mortality.

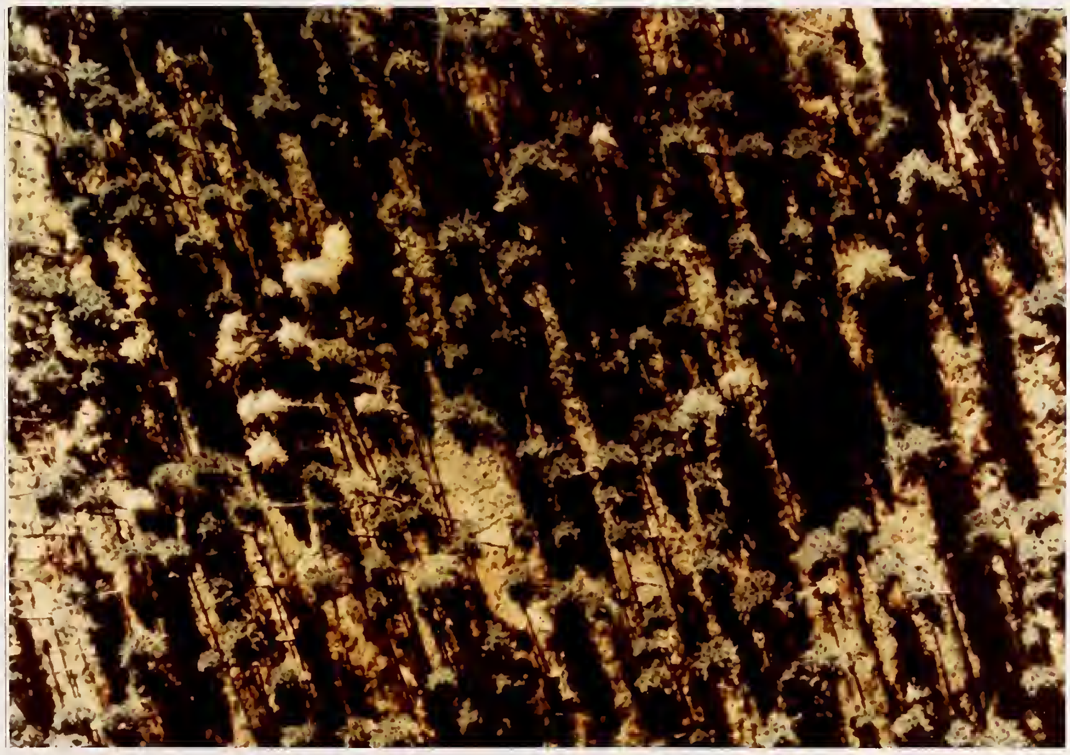


Figure 3.--Small group and single-tree mortality caused by root disease in stands.

Confirmed locations of mortality centers or concentrations of scattered and small-group mortality associated with the major root disease pathogens are shown on maps (figs. 4, 5, 7, 8, and 9). This probably represents only a small fraction of root disease in the State.

Armillaria Root Rot

Armillaria root rot is common on all except the Custer NF but is heaviest in a band across the middle of the State which includes the Missoula, Ninemile, Superior, Plains, Thompson Falls, and Seeley Lake Districts of the Lolo NF; lower Trout Creek District of the Kootenai NF; Lincoln District of the Helena NF; and Rocky Mountain, Belt Creek, and Judith Districts of the Lewis and Clark NF (fig. 4). Parts of the Flathead Indian Reservation and some private lands are included in the area of known concentration. Further surveys of the Flathead and Kootenai NF's are expected to reveal additional concentrations of Armillaria root rot.

The Deerlodge and Beaverhead NF's appear to be relatively free of Armillaria root disease centers. Armillaria has been reported from many other locations than those shown on the map; only those areas in which it has been found to cause serious management problems are included.

Armillaria root rot is increasing in stands which have been thinned. This may be due to a buildup of the pathogens on the food base provided by stumps. Once established in stumps, Armillaria can move through roots to adjacent trees. Armillaria seems to be particularly aggressive in these situations, sometimes killing a large proportion of the crop trees.

Much of the area affected with Armillaria root rot that poses management problems is also infested with the velvet top fungus. These fungi frequently coexist on diseased trees. Recent research has demonstrated that the velvet top fungus acts as a wounding agent allowing Armillaria to infect roots.

Brown Cubical Root and Butt Rot

Root disease caused by the velvet top fungus largely has been overlooked in Montana. However, foresters are quite familiar with the brown cubical butt rot caused by this fungus, indicating that it is probably widespread and frequent, particularly in Douglas-fir. Reports also state that butt decay caused by the velvet top fungus is prevalent in ponderosa pine on the Custer NF.

Areas known to have especially damaging root disease caused by the velvet top fungus are the Ninemile, Missoula, and Seeley Lake Districts of the Lolo NF; Lincoln District of the Helena NF; and the southern half of the Rocky Mountain District of the Lewis and Clark NF (fig. 5). The Hungry Horse District of the Flathead NF also has extensive areas with severe infections. A Douglas-fir beetle outbreak on this District in 1981 was associated with brown cubical root rot. Considerable infection is suspected in the White Sulphur Springs District of the Lewis and Clark NF and has been confirmed near Smokey Mountain. Extensive infection resulted in a pocket of mortality several acres in size on the Sula District of the Bitterroot NF. Mixed conifer stands on Champion International Corporation land west of Kalispell are also heavily infested with brown cubical root and butt rot. Ponderosa pine as well as Douglas-fir were affected with nearly all trees having root and butt rot.

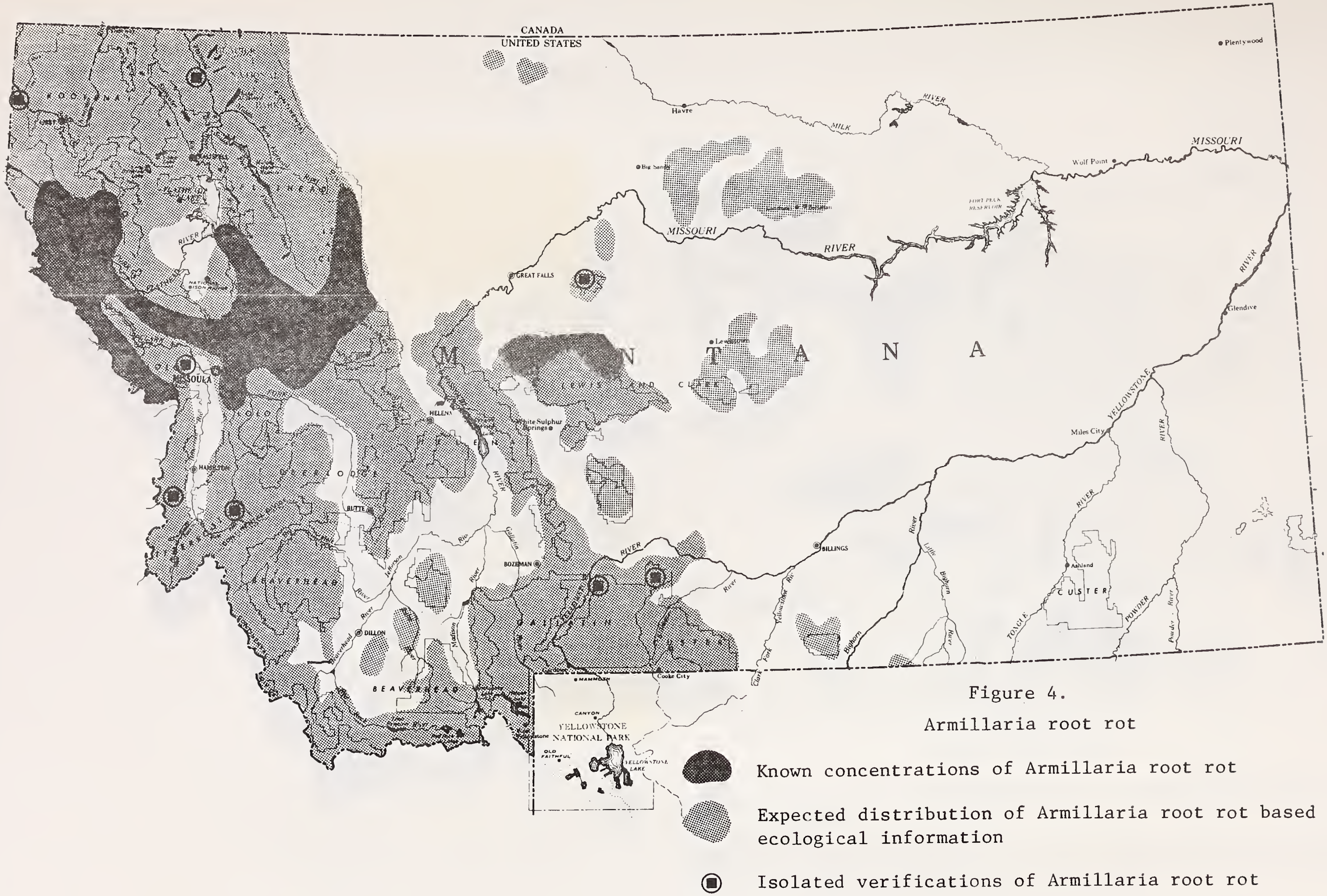


Figure 4.

Armillaria root rot

Known concentrations of Armillaria root rot

Expected distribution of Armillaria root rot based on ecological information

Isolated verifications of Armillaria root rot

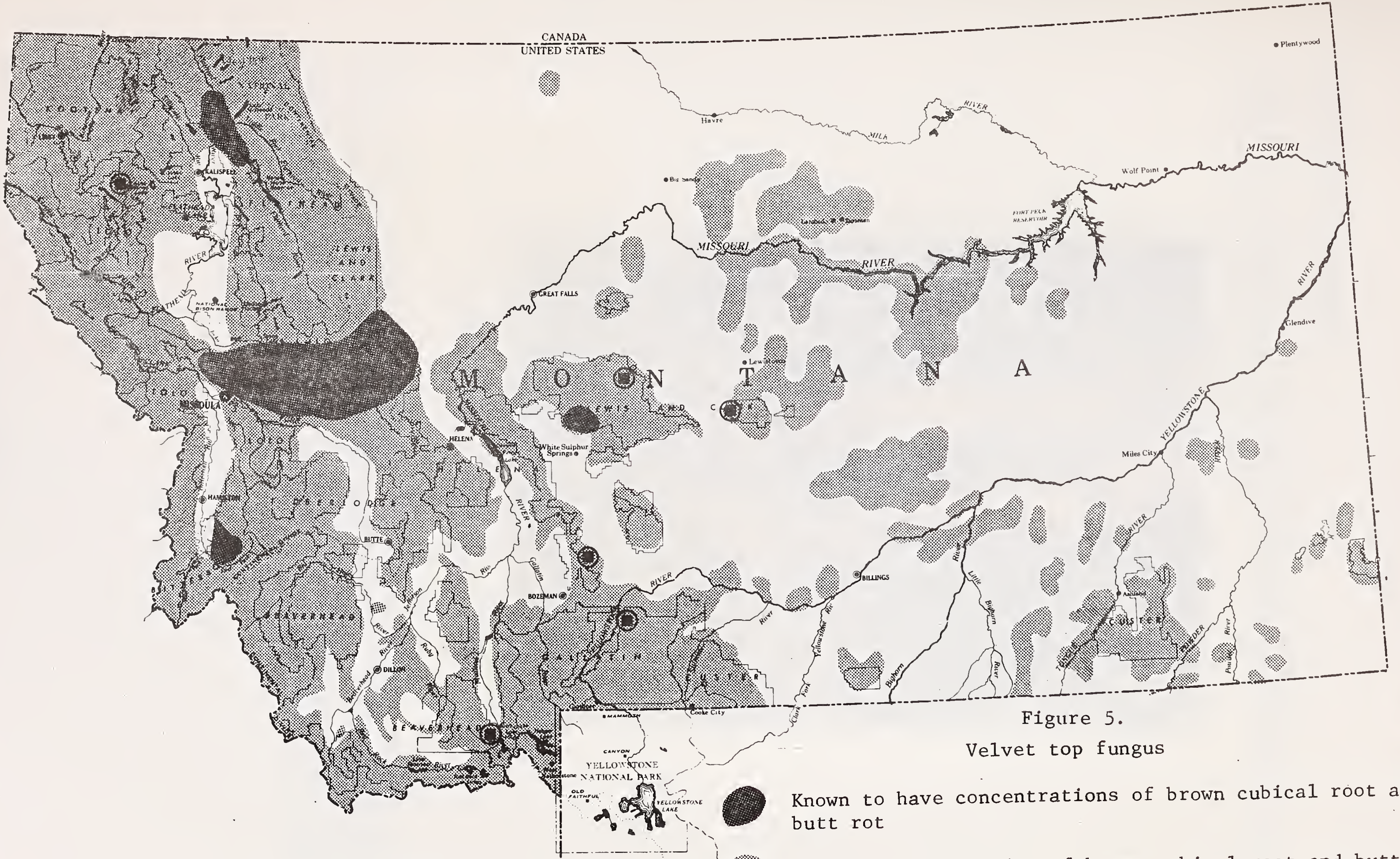


Figure 5.

Velvet top fungus

● Known to have concentrations of brown cubical root and butt rot

▨ Expected distribution of brown cubical root and butt rot based on ecological information

◉ Isolated verifications of brown cubical root and butt rot

Black Stain Root Disease

Black stain root disease is being found with increasing frequency (fig. 6). It is sometimes a precursor to Armillaria root rot and has been found in large mortality centers.

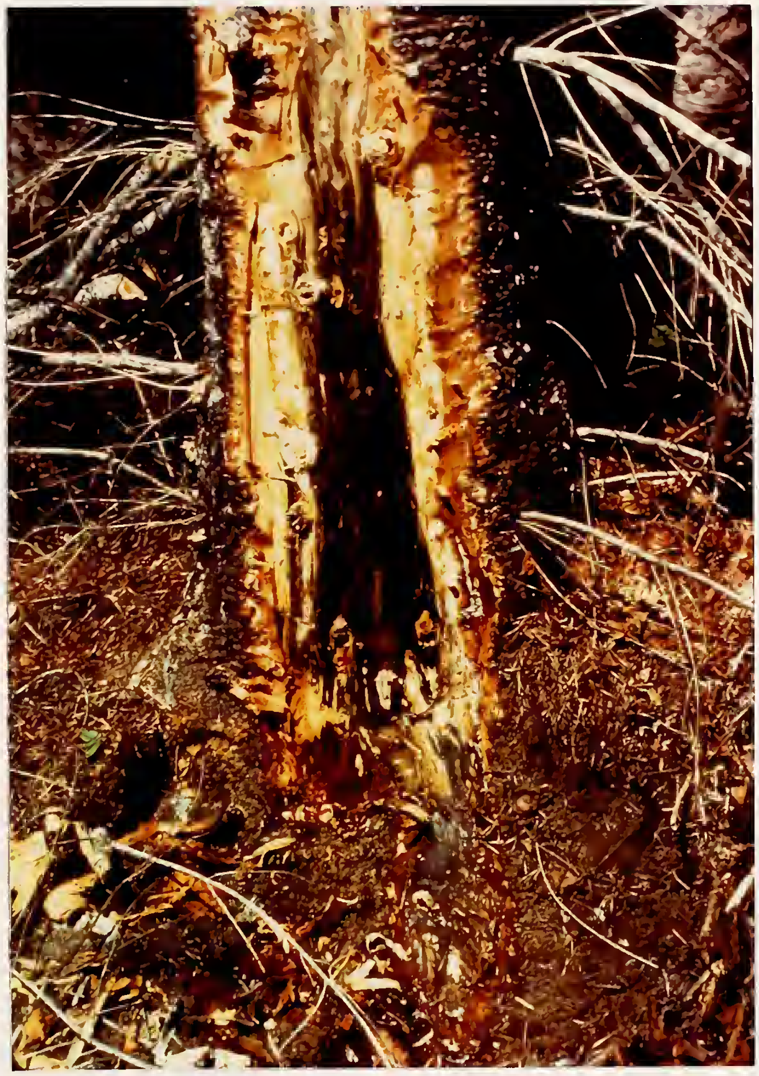


Figure 6.--Black stain root disease.

It has been detected in root disease centers on the Lolo, Kootenai, and Flathead NF's, on the Flathead Indian Reservation, and on the Lincoln District of the Helena NF (fig. 7). In Douglas-fir root disease centers, complete root excavation has been required to diagnose black stain in trees which otherwise appear only to have Armillaria root rot or, occasionally, brown cubical root rot.

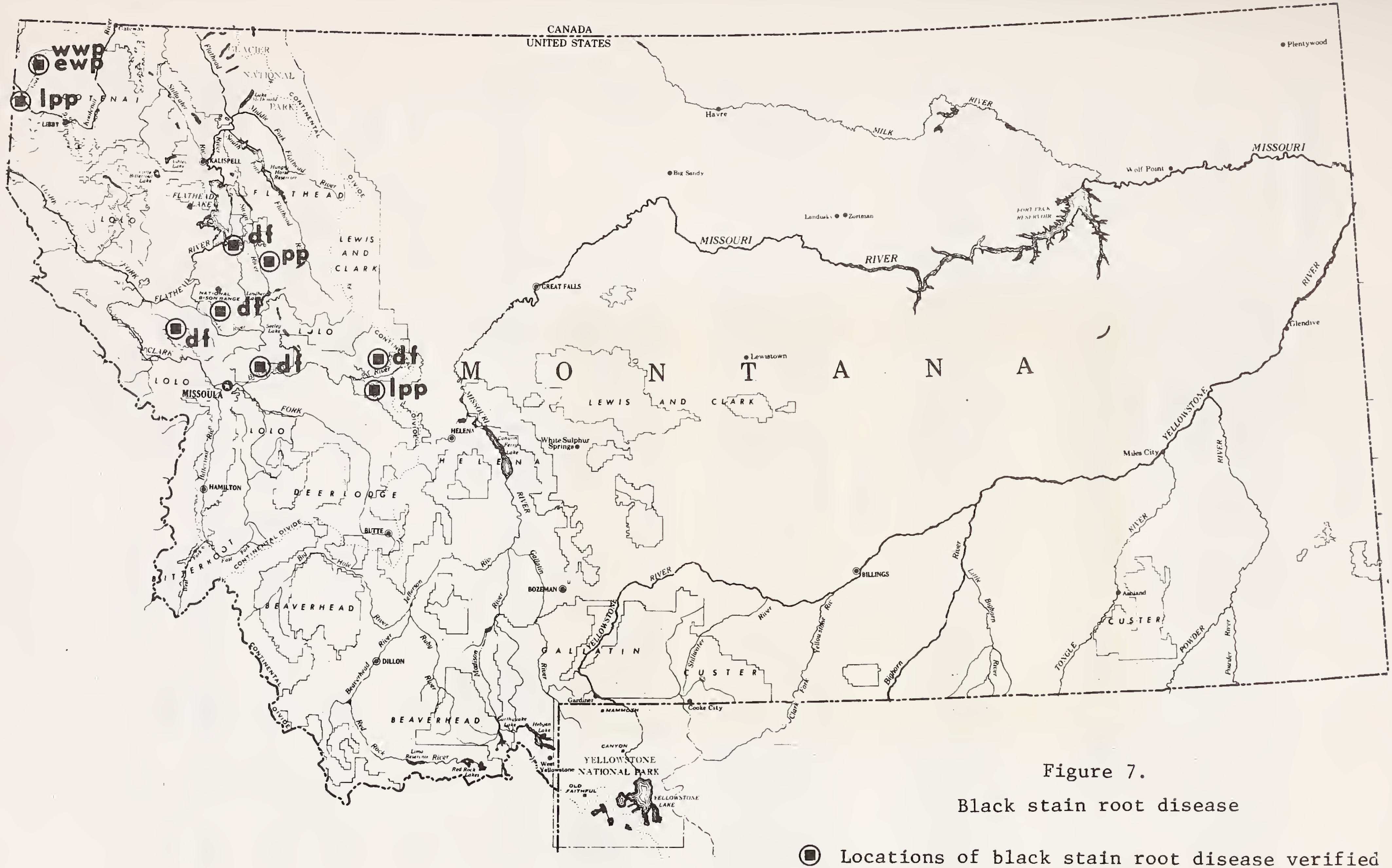


Figure 7.

Black stain root disease

◙ Locations of black stain root disease verified

Annosus Root Rot

Annosus root rot was found on subalpine fir in several locations in 1981 (fig. 8). These trees had some western balsam bark beetle associated, but generally not enough to implicate the beetle as a cause of death. Annosus root rot is also found causing localized pine and Douglas-fir mortality, particularly where tree roots contact infected stumps.

Some evidence indicated thinning often provides an impetus to increase annosus root rot in ponderosa pine stands in Montana. Stump surfaces probably provide a suitable substrate for infection by airborne spores.

Laminated Root Rot

Laminated root rot is an important root disease of Douglas-fir on the west Lolo and Kootenai NF's (fig. 9). Particularly severe infections were found in stands surrounding the Clark Fork River on these Forests. Evaro is the most easterly location of laminated root rot found to date.

DWARF MISTLETOE

Growth reduction resulting from dwarf mistletoe infections causes significant losses in productivity of Douglas-fir, western larch, and lodgepole pine in Montana forests (table 9). Douglas-fir and western larch dwarf mistletoes are limited to roughly west of the Continental Divide; only lodgepole pine dwarf mistletoe occurs throughout the State.

Table 9.--Dwarf mistletoe impact in Montana

	Lodgepole pine		Douglas-fir		Western larch	
Landownership	Area infested M acres	Annual growth reduction M ft^3	Area infested M acres	Annual growth reduction M ft^3	Area infested M acres	Annual growth reduction M ft^3
Nat'l. Forest	1,255.8	13,267.6	247.1	4,492.0	191.0	3,820.0
Other Federal	69.8	725.5	30.2	604.0	22.6	452.0
Industrial Private	29.5	354.7	44.4	888.0	51.2	1,024.0
Nonindustrial Private	217.0	2,280.0	97.6	1,952.0	86.4	1,728.0
State/County/ Municipal	29.2	335.1	25.1	502.0	18.7	374.0
Total	1,601.3	16,963.7	444.4	8,888.0	369.9	7,398.0

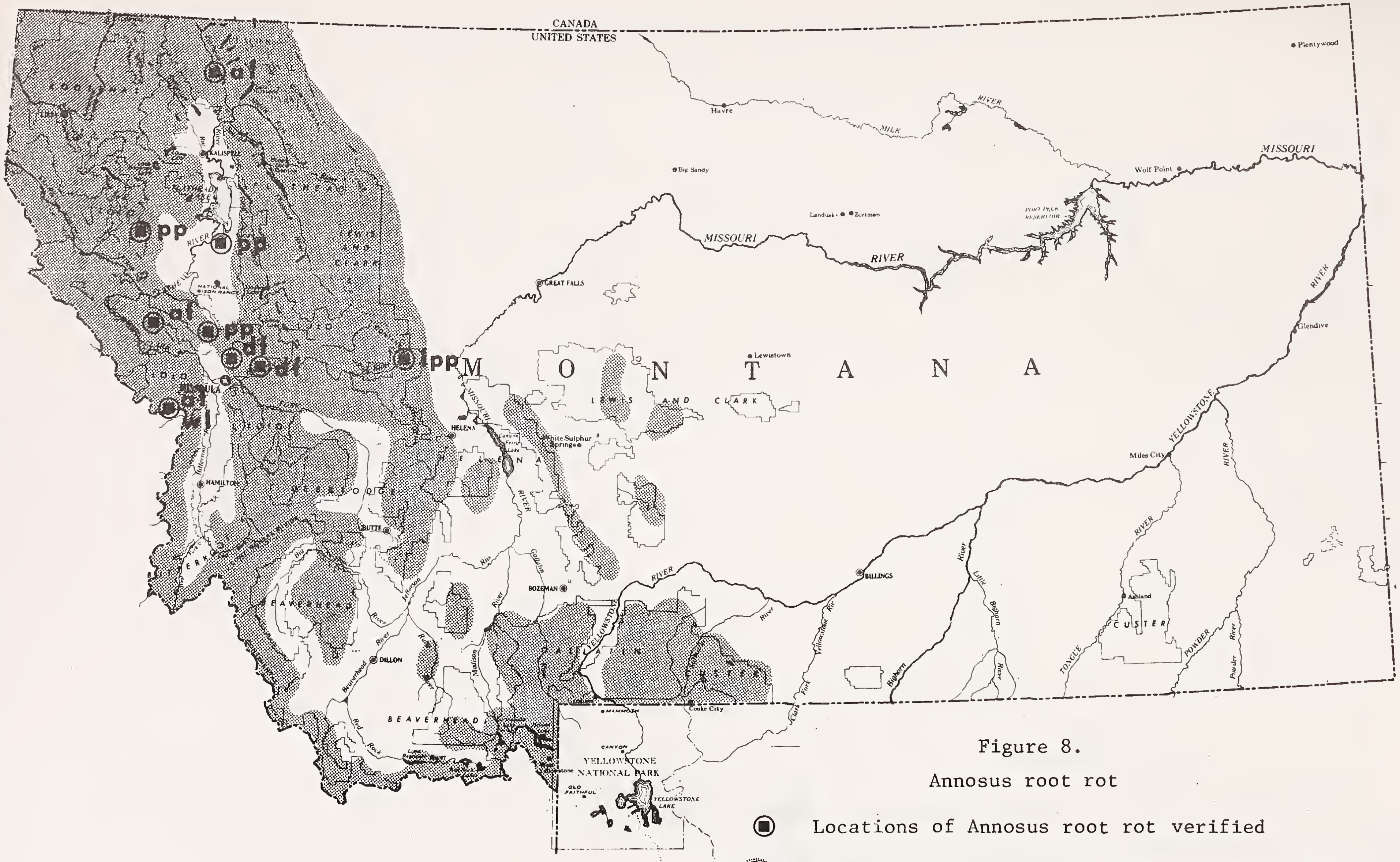


Figure 8.

Annosus root rot

◙ Locations of Annosus root rot verified

▨ Expected distribution of Annosus root rot based on ecological information

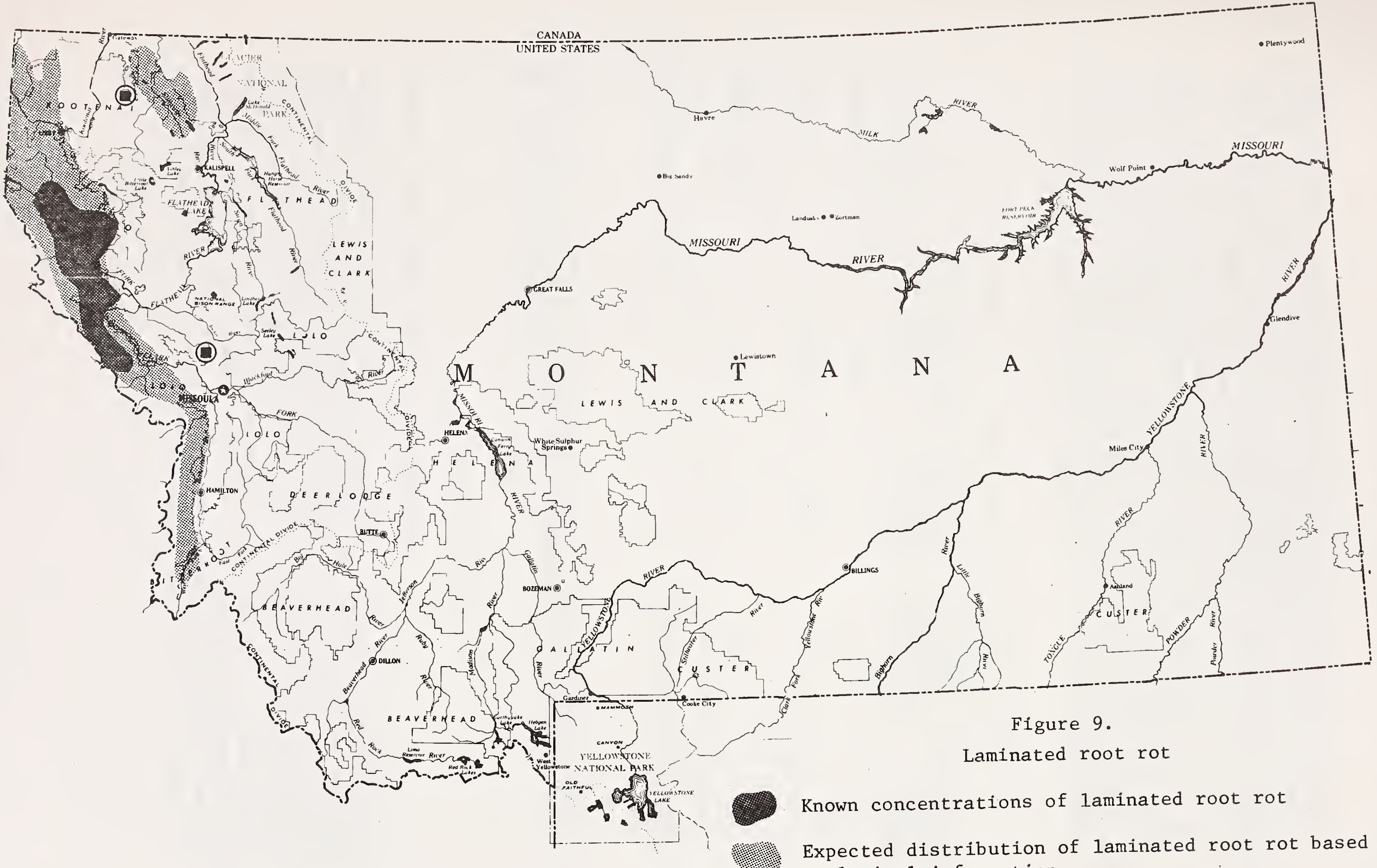


Figure 9.
Laminated root rot

● Known concentrations of laminated root rot

▨ Expected distribution of laminated root rot based on ecological information

◉ Isolated verifications of laminated root rot

Dwarf mistletoe can be effectively controlled through silvicultural treatment. If properly planned, these treatments can be applied at little or no additional cost during thinning, regeneration cutting, and site preparation. Some stands require special treatment due to particularly heavy losses in productivity. One hundred thirty-six acres of land requiring special dwarf mistletoe suppression projects on the Bitterroot NF were inspected this year, and 714 additional acres were treated on the Bitterroot and Lolo NF's and the Garnet Resource Area, Bureau of Land Management. Biological evaluations of dwarf mistletoe were conducted on 844 acres, and presuppression surveys were completed on 2,250 acres on the Bitterroot and Lolo NF's and the Garnet Resource Area, Bureau of Land Management (table 10).

Table 10.--Dwarf mistletoe program, 1981

Location	Presuppression survey (acres)	Biological evaluation (acres)	Control implemented (acres)	Postsuppression survey (acres)
Bitterroot NF 1/	200	343	343	136
Lolo NF	1,050	300	170	-
Garnet Resource Area, BLM 2/	1,000	201	201	-

1/ National Forest

2/ Bureau of Land Management

Dwarf mistletoe control has become a part of routine stand treatment in many parts of Montana, resulting in decreased losses as stands are brought under management.

FOLIAGE DISEASES

Western Larch Needle Blight and Needle Cast

Foliage diseases were prevalent throughout the State in 1981 due to wet weather during bud burst and leaf expansion. Most damaging and spectacular was the combination of Hypodermella blight and Meria needle cast on western larch. Hypodermella blight caused infected needles to turn red-brown and droop by early June. Spur shoots and new succulent branches were killed back and many thousands of trees, especially seedlings, were nearly completely defoliated. Needles which escaped Hypodermella blight were often affected by Meria needle cast. Meria continued to reinfect needles until late July. Infected needles died within 2-4 weeks and were cast. Trees which refoliated after severe damage by Hypodermella blight were attacked by Meria. Radial growth is expected to be somewhat reduced in 1982 as a result of Hypodermella and Meria infections in 1981.

Elevated levels of infection by these fungi is expected again in 1982. If wet weather persists during leaf expansion in 1982, higher levels of damage than those in 1981 are predicted since the spore load has been building for the past 2 years. If spring weather is relatively dry in 1982, infection will still be above endemic levels, but it should decline rapidly as long as dry spring weather persists.

Lodgepole Pine Needle Cast

Lophodermella needle cast on lodgepole pine was also notable in 1981. The discoloration was a result of infections which occurred during the wet spring of 1980. Rain during bud burst and early needle expansion again in 1981 is expected to produce even more spectacular symptoms in 1982 regardless of the coming spring weather. Infected needles will turn red in June or July and be cast by September.

Rain during needle expansion in 1982 would result in high levels of infection again which will be seen in red needles which would be cast by September 1983.

Other Leaf Diseases

Other leaf diseases frequently reported in 1981 were leaf blight, ink spot, and Marssonina leaf spot of aspen. These were severe throughout the State where aspen occurs. Damage intensity varied considerably between clones.

Douglas-fir needle cast was severe in a few locations. Leaf rusts on true firs were heavy in local areas throughout the State, especially on individual trees. Powdery mildews were reported on silver maple, American linden, and aspen.

STEM DISEASES

White Pine Blister Rust

White pine blister rust continues to be a major cause of mortality where western white pine occurs on the Lolo and Kootenai NF's. Damage is especially severe in seedlings and saplings; girdling is more rapid than in larger trees. Recent developments in white pine blister rust research will allow stand and site hazard rating to be used to determine appropriate management.

Seed trees selected for rust resistance and seed from seed orchards with demonstrated rust resistance are resulting in greatly improved survival of white pine seedlings and saplings in Idaho. These methods are certainly applicable to western Montana and may renew emphasis on white pine management.

Comandra Rust

Comandra rust on stems of lodgepole pine was found frequently in some stands on the Ennis District, Beaverhead NF. Infections by comandra rust are often confused with porcupine, squirrel, or other rodent damage, because rodents feed on infected tissue. Sapling lodgepole pine regeneration on the Beaverhead National Forest and on Champion International lands west of Kalispell was moderately affected by comandra rust with occasional tree death often accompanied by rodent chewing. In both locations surrounding uncut stands were heavily infected with the rust and the plantations provided ample habitat for the alternate host, bastard toadflax.

Western Gall Rust

Western gall rust caused localized patches of mortality in Scotch pine Christmas tree plantations north of Flathead Lake. The rust was probably present on trees received from the nursery.

Larch Canker

A canker disease discovered in 1967 in a young larch stand owned by Champion International Corporation west of Kalispell was thought to be caused by two canker-causing fungi. It was predicted in 1969 that the disease would have less impact as the trees matured; reexamination of the stand in 1981 substantiated the prediction. While the canker disease was still evident on some trees and had resulted in multiple leaders in some, the number of active infections were considerably fewer than in 1967. Less than 1 percent of the larch are infected.

STEM DECAY

Stem decays are among the most economically important diseases of Montana forests. They greatly reduce the productivity of some stands and cause considerable volume losses Statewide. Specific losses are unknown.

Red Ring Rot

Red ring rot, also known as red heartrot or white pocket rot, is probably the most damaging stem decay in Montana. This rot is common in Douglas-fir, western larch, lodgepole pine, and ponderosa pine throughout the State and causes high rates of cull in some severely affected stands. A pole-sized lodgepole pine stand on the Helena NF was about 90 percent infected. The fungus gains access to heartwood of living trees through branch stubs and stem wounds.

Other Stem Decays

Brown cubical butt rot of Douglas-fir and ponderosa pine, and other conifers is also common in Montana. Cull rates can be high in some stands where the velvet top fungus acts as a butt decay as well as a root decay. Figure 10 shows the known distribution of brown cubical root rot, which is generally accompanied by butt rot.

Fire scars and other basal wounds are infrequent sources of infection by the velvet top fungus, but decay may extend from 20 to 30 feet in the butt log when associated with wounding.

The Indian paint fungus causes high cull rates in some stands of grand fir, western hemlock and subalpine fir in western Montana. Slow growing stands on wet bottom sites are particularly damaged.

Anceps decay occurs frequently in ponderosa pine on the Custer National Forest. The distribution and frequency of anceps decay in Montana is unknown, in part due to the similarity of anceps decay to red ring rot which results in difficulty of identification.

REGENERATION DISEASES

Two sapling stands of planted ponderosa pine with Douglas-fir and grand fir naturals on the Kootenai National Forest north of Thompson Falls had numerous expanding pockets of Armillaria root rot. Pockets were centered around one or more infected stumps from the previous stand. Surrounding stands had groups of trees killed by laminated root rot and by Armillaria root rot. Armillaria root rot killed seedlings near stumps in clearcut areas in numerous other sites in Montana.

Hypodermella needle blight and Meria needle cast of larch killed 28 percent of the seedlings in two stands near the Idaho-Montana border in Idaho. Many stands were found in Montana in which seedlings were as heavily infected as those in Idaho, and the mortality rates were probably comparable. Seedlings from the St. Regis Nursery in Libby were heavily infected with both Hypodermella and Meria. Growth reduction may cause a higher percentage of seedlings to be culled. Spray schedules are now available for these fungi in nurseries should wet spring weather make protection of seedlings necessary.

Smothering disease of outplanted seedlings was again reported from two locations in western Montana.

Rhizoctonia tip rot was found killing spruce germlings in Christmas tree beds north of Flathead Lake. The origin of the disease is unknown and this is believed to be a new local record.

Problems with Botrytis blight continue to plague several greenhouse nurseries in the State. Severe damage occurred at the BIA facility in Ronan; we suspect strains of the fungus have developed tolerance to commonly used fungicides.

ENVIRONMENTAL

Frost damage was widespread in the State this year due to a late spring frost. Winter drying, known as "red belt," was evident in forests east of the Divide, but caused relatively little new mortality. Large areas of winter drying occurred in the Judith Mountains north of Lewistown and in the North and South Moccasin Mountains northwest of Lewistown. It also was prevalent in lodgepole pine stands on high ridges in the headwaters of the Judith River.

APPENDIX

LIST OF COMMON AND SCIENTIFIC NAMES

Common name	Scientific name
	INSECTS
A new budworm	*Argyrotaenia* sp. near *gogana* (Kearfott)
Cooley spruce gall aphid	*Adelges cooleyi* (Gillette)
Douglas-fir beetle	*Dendroctonus pseudotsugae* Hopkins
Douglas-fir tussock moth	*Orgyia pseudotsugata* McDunnough
Larch casebearer	*Coleophora laricella* (Hubner)
Lodgepole terminal weevil	*Pissodes terminalis* (Hopkins)
Mountain pine beetle	*Dendroctonus ponderosae* Hopkins
Pine bark aphid	*Pineus silvestris* Annand
Pine engraver	*Ips pini* (Say)
Ponderosa pine needle miner	*Coleotechnites* sp.
Spruce beetle	*Dendroctonus rufipennis* (Kirby)
Ten-lined June beetle	*Polyphylla decemlineata* (Say)
Western balsam bark beetle	*Dryocoetes confusus* Swaine
Western pine beetle	*Dendroctonus brevicomis* LeConte
Western spruce budworm	*Choristoneura occidentalis* Freeman
	DISEASES
Anceps decay	*Polyporus anceps* Pk.
Annosus root rot	*Fomes annosus* (Fr.) Cke.
Armillaria root rot	*Armillaria mellea* Vahl. ex Fr.
Aspen leaf blight	*Venturia tremulae* Aderh.
Black stain root disease	*Verticicladiella wageneri* Kend.
Botrytis blight	*Botrytis cinerea* Pers. ex Fr.
Brown cubical root and butt rot	*Phaeolus schweinitzii* (Fr.) Pat.
Comandra blister rust	*Cronartium comandrae* Peck.
Damping-off of seedlings	*Fusarium oxysporum* (Schl.) em. Snyd. & Hans.
Douglas-fir needle cast	*Rhabdocline pseudotsugae* Syd.
Dwarf mistletoe	
Douglas-fir	*Arceuthobium douglasii* Engelm.
Lodgepole pine	*Arceuthobium americanum* Nutt. ex Engelm.
Western larch	*Arceuthobium laricis* (Piper) St. John
Hypodermella blight	*Hypodermella laricis* Tub.
Indian paint fungus	*Echinodontium tinctorium* (E. & E.) E. & E.
Ink spot	*Ciborinia confundens* (Whetz.) Whetz.
Laminated root rot	*Phellinus weirii* (Murr.) Gilb.
Larch canker	*Cytospora abietis* Sacc. *Phomopsis pseudotsugae* Wils.
Lophodermella needle cast	*Lophodermella concolor* (Dear.) Dark.
Marssonina leaf spot	*Marssonina populi* (Lib.) Magn.
Meria needle cast	*Meria laricis* Vuill.
Powdery mildew	
American linden	*Microsphaera alni* DC. ex Wint.
Aspen	*Uncinula salicis* (DC. ex Merat) Wint.
Silver maple	*Phyllactinia guttata* (Fr.) Lev.
Red ring rot	*Phellinus pini* (Thore ex Fr.) Pil.

Common name	Scientific name
	DISEASES, continued
Rhizoctonia tip rot	*Rhizoctonia* sp.
Smothering disease	*Thelephora terrestris* Ehr.
True fir leaf rusts	*Pucciniastrum geoppertianum* (Kuehn.) Kleb. *Pucciniastrum epilobii* Otth.
Western gall rust	*Endocronartium harknessii* (Moore) Hirat.
White pine blister rust	*Cronartium ribicola* Fischer ex. Rabh.

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